INTERNATIONAL STANDARD

ISO 28199-3

Second edition
2021-06

Paints and varnishes — Evaluation of properties of coating systems related to the spray application process —

Part 3: Assessment of sagging, formation of bubbles, pinholing and hiding power

Peintures et vernis — Évaluation des propriétés des systèmes de revêtement liées au mode d'application par pulvérisation —

Partie 3: Évaluation du festonnage, de la formation de bulles, des piqûres et du pouvoir masquant

Reference number
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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 139, *Paints and varnishes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 28199-3:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the terms bubble formation limit and cratering have been moved from ISO 28199-1 to this document;

— assessment using measuring techniques was added for all evaluations;

— process hiding power (see Clause 7) was changed to hiding power;

— 3-D photographs and the associated profiles have been included for bubbles and pinholes;

— the normative references have been updated;

— the document has been editorially revised.

A list of all parts in the ISO 28199 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In many areas (e.g. car manufacture, industrial coatings, coatings for plastics) the coating materials used are adapted to the specific application equipment and technologies of the particular user. A coating material is, therefore, to be understood as a semi-manufactured product that only receives its final form in combination with the specific application conditions. The adaptation to the application conditions is therefore decisive for the quality of the coated product.

The test methods specified in the ISO 28199 series are based on studies by a Working Group of the European Council for Automotive R&D (EUCAR).

They may be used for evaluation of coating materials in research, development and production with regard to their suitability and safety for industrial processes, and error analysis. The properties of coating materials and coatings to be evaluated depend on the film thickness, so a coating system of increasing thickness is applied to a test panel under defined conditions.

The following characteristics are measured (see ISO 28199-1):

— film thickness in accordance with ISO 2808;

— surface texture;

— colour in accordance with ISO 18314-1;

— mottling;

— gloss in accordance with ISO 2813.

The following properties are determined in combination with visual assessment or, if necessary, optical measurement techniques:

— colour stability/colour evaluation, process hiding power, re-dissolving, overspray absorption, wetting, surface texture and mottling (see ISO 28199-2);

— tendency to sagging, formation of bubbles, pinholing and hiding power (this document).

Paints and varnishes — Evaluation of properties of coating systems related to the spray application process —

Part 3:
Assessment of sagging, formation of bubbles, pinholing and hiding power

IMPORTANT — The electronic file of this document contains colours which are considered to be useful for the correct understanding of the document. Users should therefore consider printing this document using a colour printer.

1 Scope

This document specifies visual methods for the assessment of tendency to sagging, formation of bubbles, pinholing and hiding power of coating materials applied to a test panel under defined conditions, using spray application process. Assessment using measuring techniques is also described for all evaluations.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6504-3, *Paints and varnishes — Determination of hiding power — Part 3: Determination of hiding power of paints for masonry, concrete and interior use*

ISO 28199-1:2021, *Paints and varnishes — Evaluation of properties of coating systems related to the spray application process — Part 1: Vocabulary and preparation of test panels*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 28199-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
bubble formation limit
start of a number of bubbles, agreed between the interested parties, in a measurement field

Note 1 to entry: A single bubble does not define the bubble formation limit. Bubbles at the edge of the measuring area and in the perforated area of the panel (see Figure 1) should not be taken into account.

3.2
cratering
formation in a film or coating of small circular depressions that persist after drying/curing

Note 1 to entry: Craters can extend into deeper layers of a coating or into the substrate.

Note 2 to entry: Cratering is caused by limited irregularities in the surface tension of the coating. Contamination of the substrate or coating with incompatible materials such as small oil drops or particles are the most frequent causes.

[SOURCE: ISO 4618:2014, 2.66, modified.]

4 Tendency to sagging

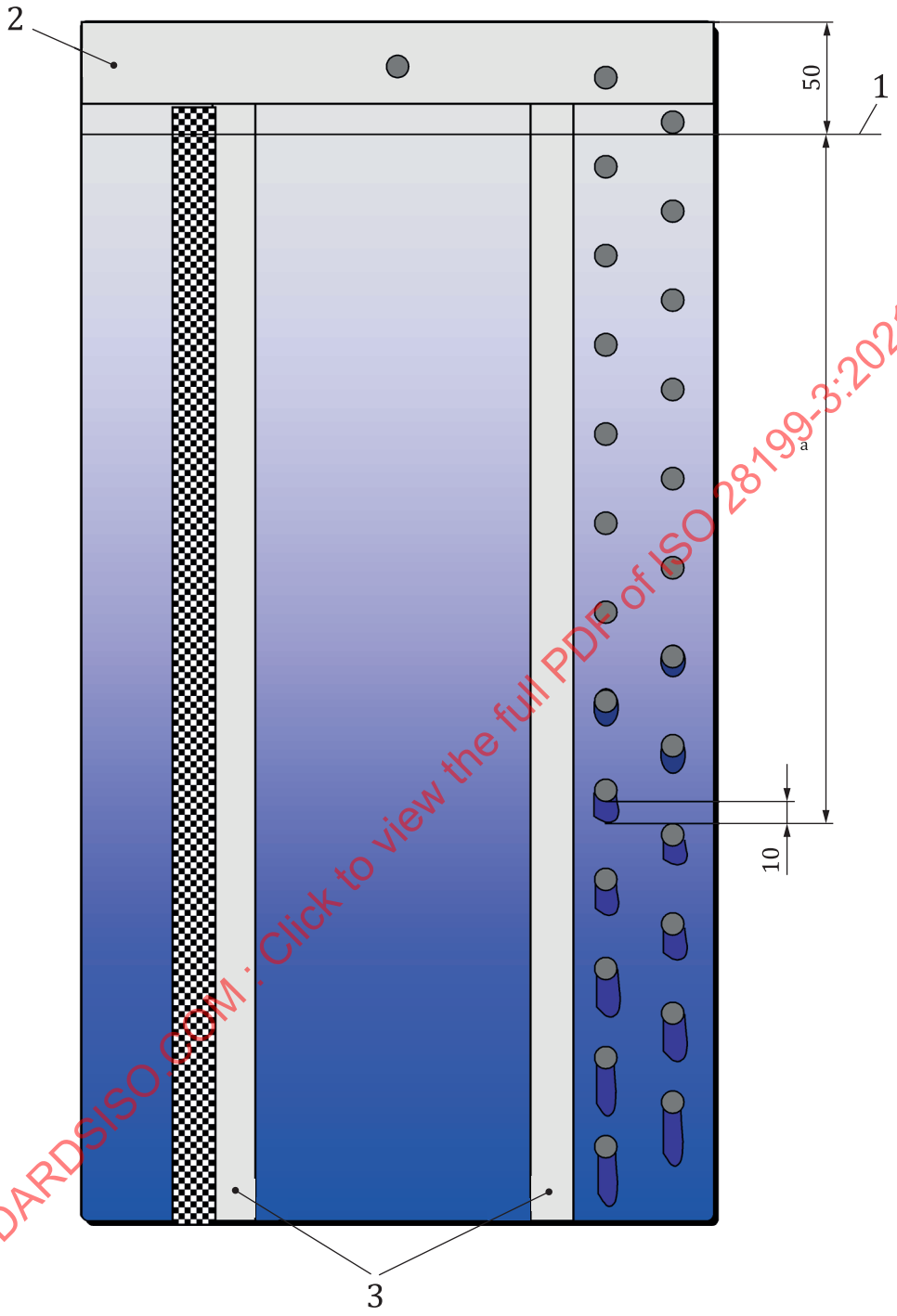
4.1 General

The tendency to sagging is determined by visual assessment or measurement of runs and sags (as defined in ISO 4618, referred to as sags throughout the text). This assessment is made after drying/curing of the coating, on a panel prepared in accordance with Version A in ISO 28199-1:2021.

If a tendency to sagging is already visible in the liquid layer, this should be marked at the edge of the panel.

Film thickness is determined using the values measured in accordance with ISO 28199-1:2021, 9.4.2.

Dimensions in millimetres



Key

1 measuring series 1
2 coil-coated reference strip
3 clear-coated reference strip
[a] Distance from start of coating to a sag with a length of 10 mm.

Figure 1 — Example for the assessment of the tendency to sagging

4.2 Evaluation

After drying/curing of the coating, assess the perforated area of the test panel (see ISO 28199-1:2021, Figure 3) to assess the tendency to sagging. Determine the hole at which the sag exceeds a length of 10 mm, for example, as agreed by the interested parties, from the lower edge of the hole (see Figure 1), and determine the film thickness corresponding to that hole in accordance with ISO 28199-1:2021, 9.4.2. The greater the distance *a* for a given film thickness, the less the tendency of the coating to sag. A control chart of film thickness vs distance *a* may be helpful in this evaluation.

Other lengths of sag for measuring film thickness may be agreed by the interested parties.

5 Bubbles

5.1 General

The bubble formation limit is assessed after drying/curing of the coating. Examples of bubbles in a coating material are shown in Figures A.1 and A.2.

The film thickness is determined in accordance with ISO 28199-1:2021, 9.4.2.

5.2 Evaluation

After drying/curing of the coating, assess the bubble formation limit visually or using measuring techniques in the range of the film thickness measurement pattern in the wedge area (see ISO 28199-1:2021, Figure 4 and Figure 5).

Determine the film thickness which corresponds to this bubble formation limit by using the film thickness measurement pattern.

6 Pinholing

6.1 General

The pinholing limit is assessed after drying/curing of the coating. Examples of pinholes in a coating material are shown in Figures A.3 to A.6.

The film thickness values are determined in accordance with ISO 28199-1:2021, 9.4.2.

6.2 Evaluation

After drying/curing of the coating, assess the pinholing limit (see ISO 28199-1:2021, 3.6) visually or using measuring techniques in the range of the film thickness measurement pattern in the wedge area (see ISO 28199-1:2021, Figure 4 and Figure 5).

Using the film thickness measurement pattern, determine the film thickness corresponding to this pinholing limit.

7 Hiding power

7.1 General

With regard to hiding power, a distinction is made between process hiding power and “black/white” hiding power (see ISO 28199-1:2021, 3.7). Assessment of the hiding power limit is made after drying/curing of the coating.

The film thickness values are determined in accordance with ISO 28199-1:2021, 9.4.2.

7.2 Evaluation

After drying/curing of the coating, assess the "black/white" hiding power in accordance with ISO 6504-3 in the range of the measurement pattern of the wedge-shaped layer applied to the contrast strip.

8 Test report

Prepare a test report in accordance with ISO 28199-1:2021, Clause 12.

Annex A
(informative)

Examples of bubbles, pinholes and craters

Examples of bubbles, pinholes and craters are shown in Figures A.1 to A.13.

NOTE The photographs of craters have been included in view of the fact that pinholes (see ISO 28199-1:2021, 3.6) are often confused with craters (see 3.2).

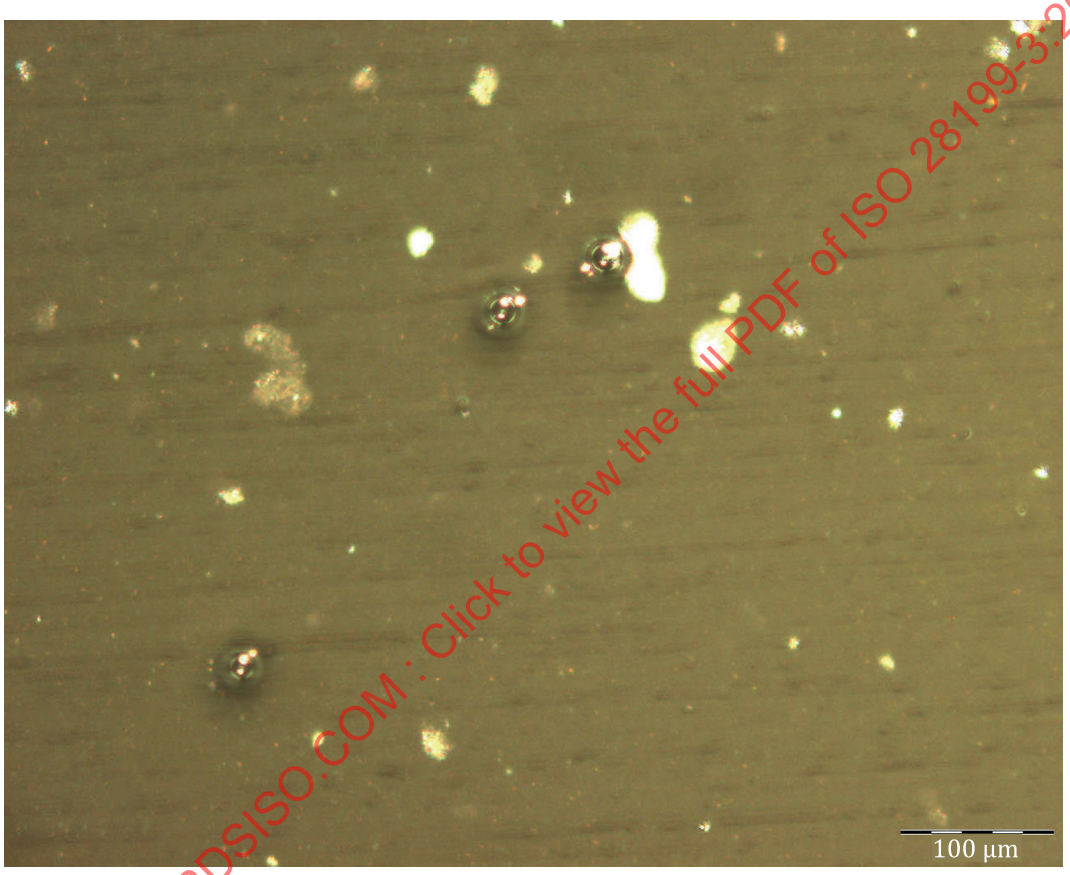


Figure A.1 — Bubbles — Top view

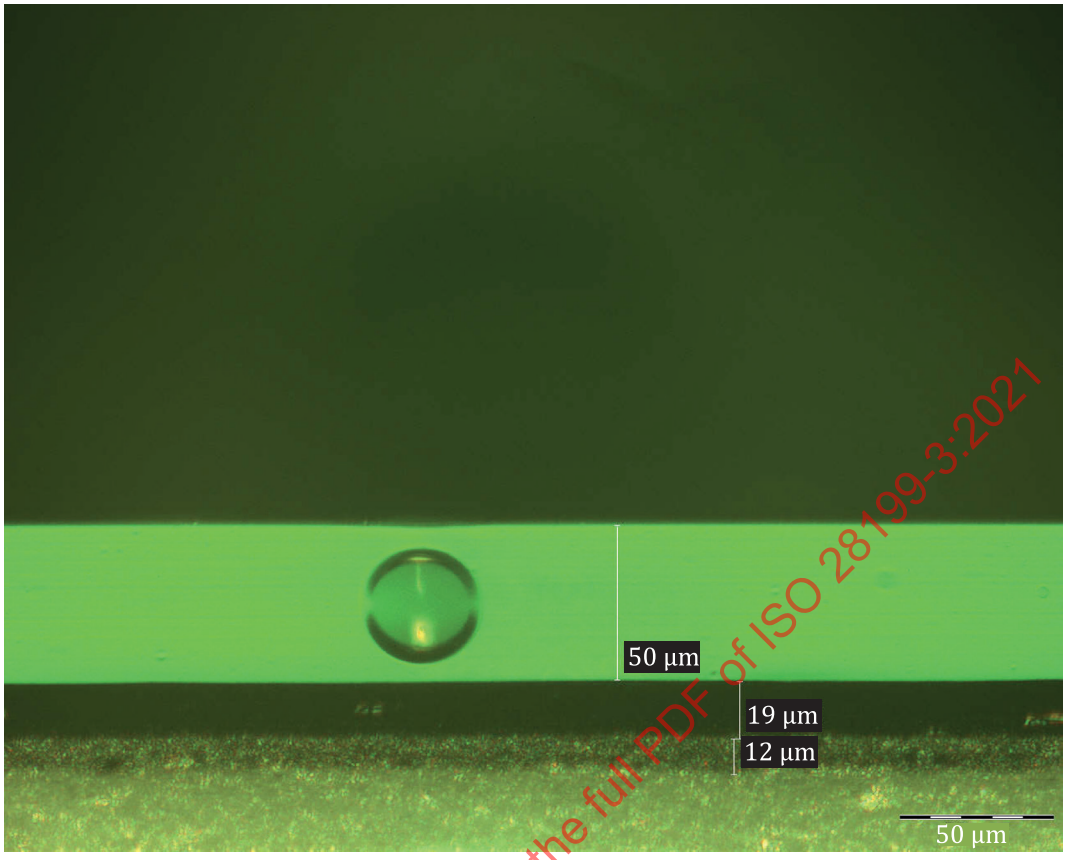


Figure A.2 — Bubbles — Cross-section

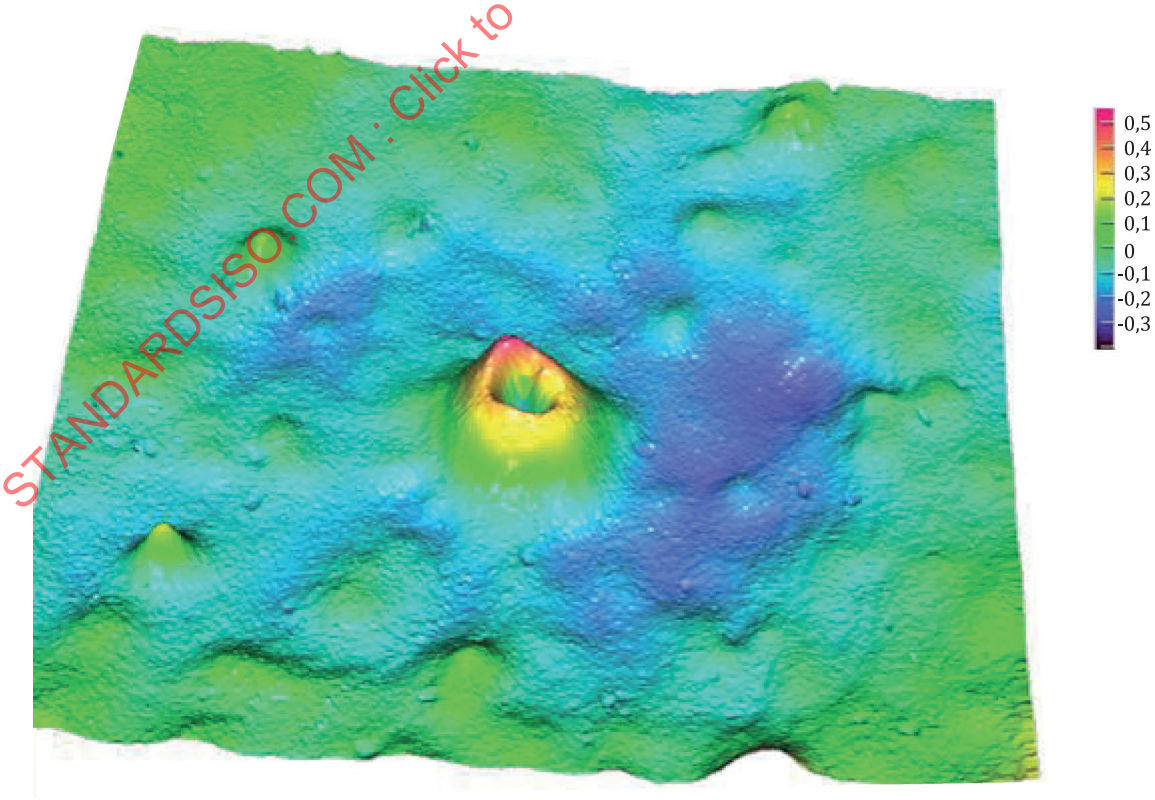
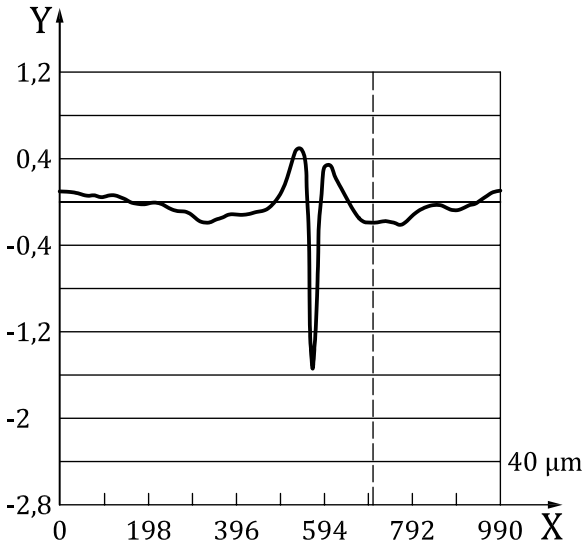


Figure A.3 — Three-dimensional representation



Key

X width of the bubble (µm)

Y depth of the bubble (µm)

Figure A.4 — Bubbles — Profile

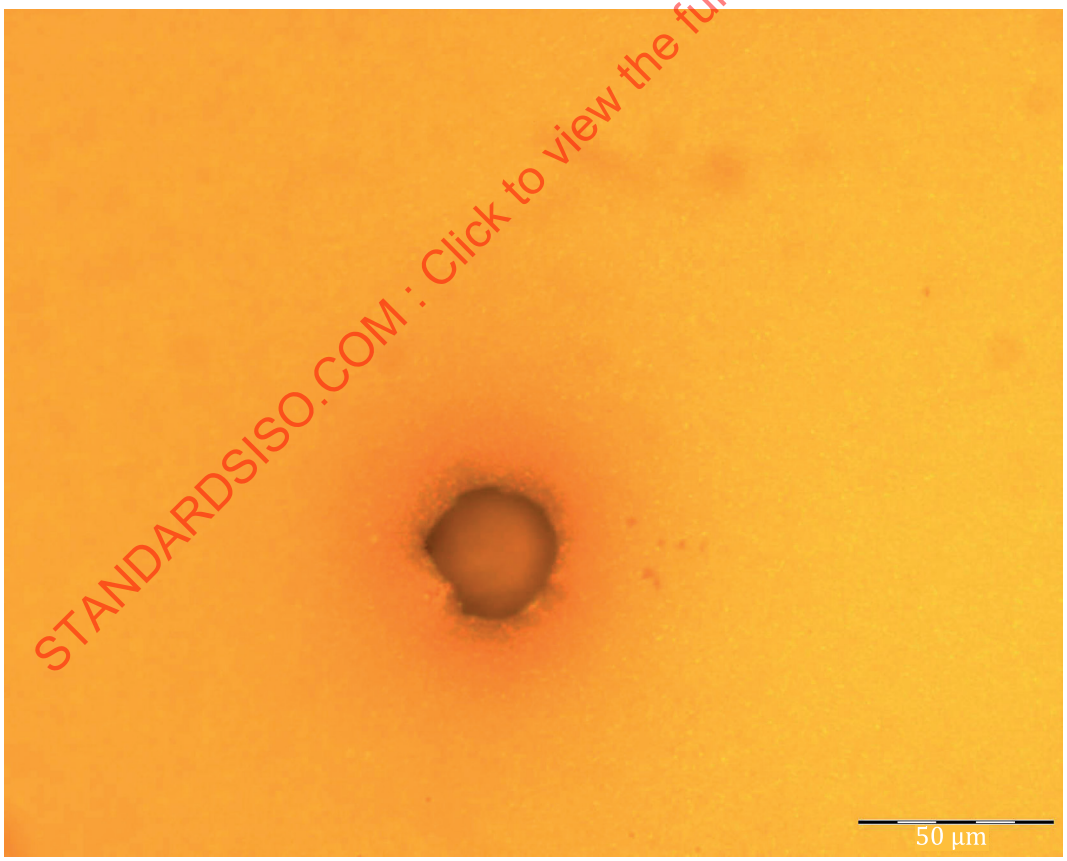


Figure A.5 — Pinhole — Top view

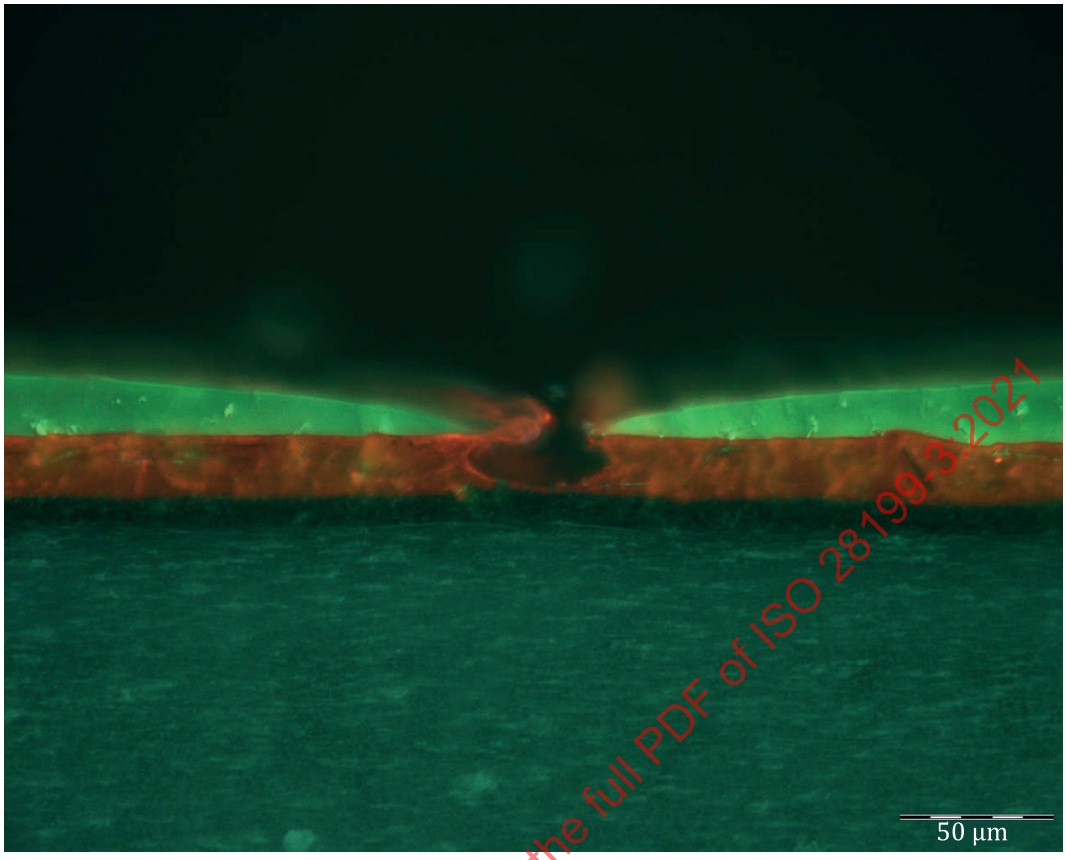


Figure A.6 — Pinhole 1 — Cross-section

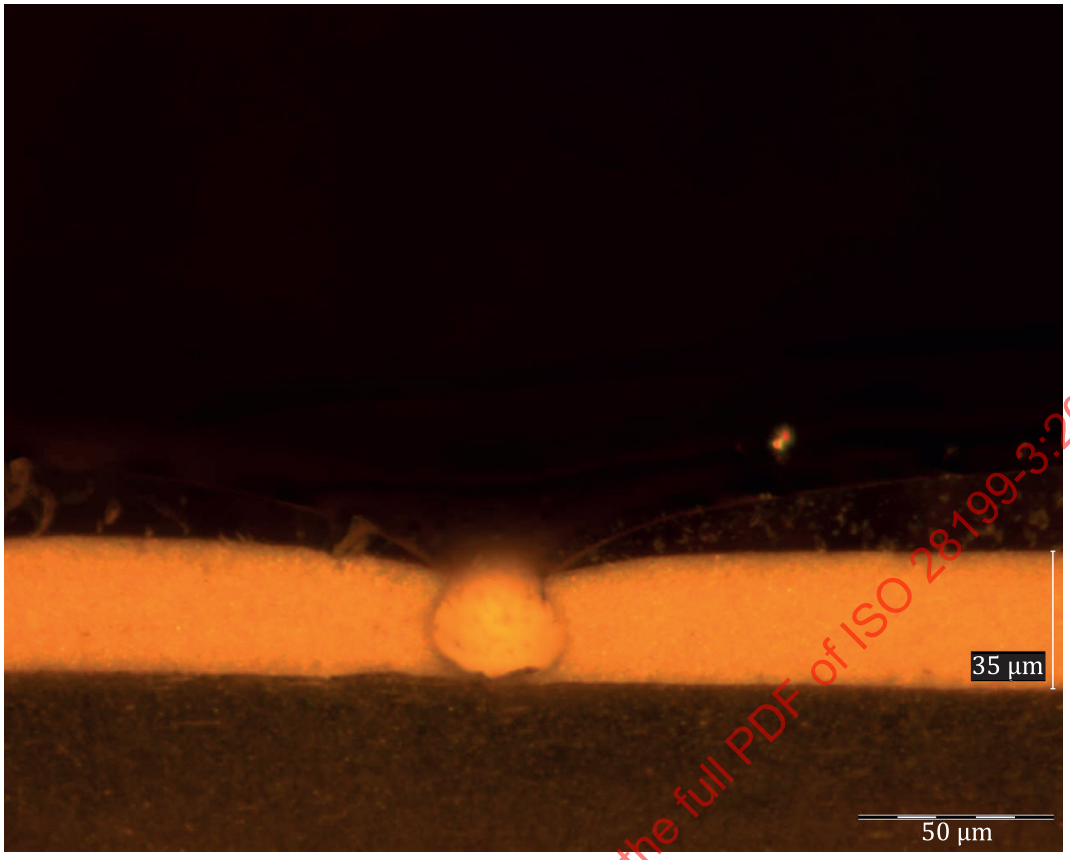


Figure A.7 — Pinhole 2 — Cross-section

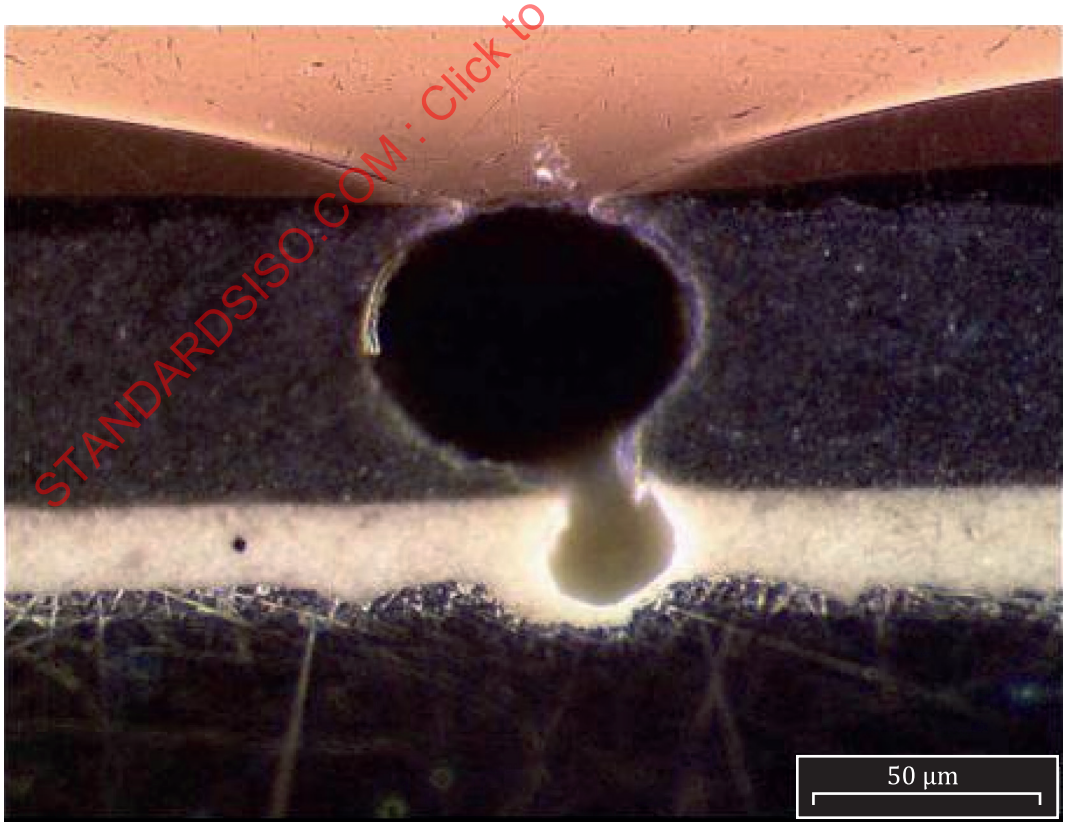


Figure A.8 — Pinhole 3 — Cross-section

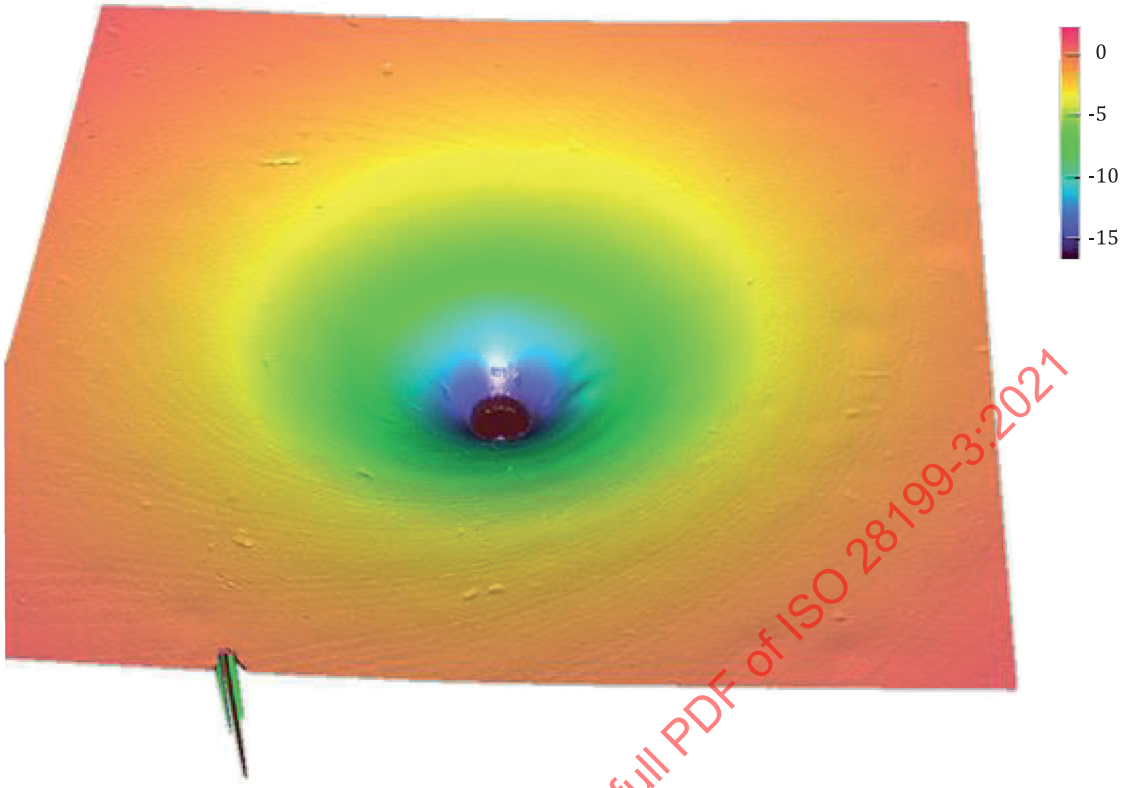
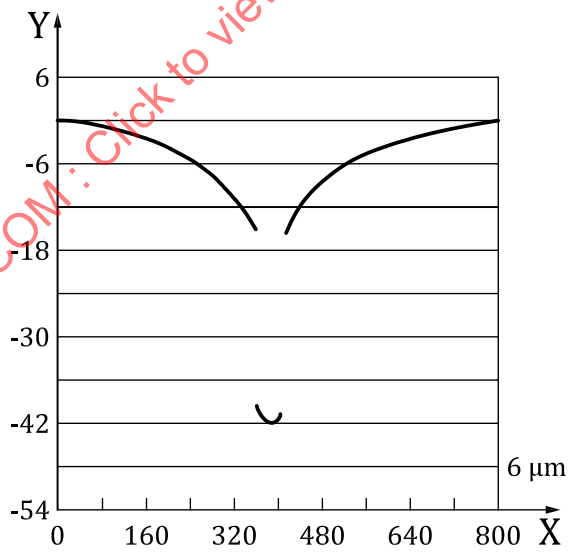


Figure A.9 — Pinhole — Three-dimensional representation



Key

X width of the pinhole (µm)

Y depth of the pinhole (µm)

Figure A.10 — Pinhole — Profile